

1. (Currently Amended) An ink jet print head, comprising:

a plurality of ink channels disposed in a common plane, each of said channels having at least one orifice for projecting ink towards a substrate; and

an ink heater made of a thermistor material having a positive temperature coefficient, the ink heater having a substantially flat plate configuration with a planar surface both facing said ink channels and extending in a plane generally parallel to the common plane of the ink channels, said planar surface being disposed adjacent to the ink channels,

wherein the thermistor material includes a first side and a second side, and the ink heater includes a first electrode and a second electrode located on the first side of the thermistor material, wherein heat is generated on the first side of the thermistor material between the first and second electrodes, and

wherein the ink heater includes a first edge and a second edge, the first edge is located opposite from the second edge, the first and second edges extend in a direction which is substantially perpendicular to the plurality of ink channels, the first electrode extends along the first edge and the second electrode extends along the second edge, wherein the first and second electrodes are opposite from one another and substantially parallel.

2. (Cancelled)

3. (Original) The print head of claim 1, wherein the ink heater is made of a ceramic thermistor material.

4. (Cancelled)

5. (Currently amended) The print head of claim 1, ~~4~~, further comprising a first lead electrically coupled to the first electrode, and a second lead electrically coupled to the second electrode.

6. (Currently amended) The print head of claim 8, ~~4~~, wherein the ink heater include a first edge and a second edge, the first edge is located opposite from the second edge, the first and second edges extend in a direction which is substantially perpendicular to the plurality of ink channels, the first electrode extends along the first edge and the second electrode extends along the second edge, wherein the first and second electrodes are opposite from one another and substantially parallel.

7. (Previously amended) The print head of claim 6, wherein the first electrode extends near a center portion of the thermistor material, and the second electrode extends near the center portion of the thermistor material, wherein the first and second electrodes are in close proximity to one another so as to minimize the time the ink heater reaches equilibrium.

8. (Currently Amended) An ink jet print head, comprising:
a plurality of ink channels disposed in a common plane, each of said channels
having at least one orifice for projecting ink towards a substrate; and
an ink heater made of a thermistor material having a positive temperature
coefficient, the ink heater having a substantially flat plate configuration with a planar
surface both facing said ink channels and extending in a plane generally parallel to the
common plane of the ink channels, said planar surface being disposed adjacent to the ink
channels,
wherein the thermistor material includes a first side and a second side, and the ink
heater includes a first electrode and a second electrode located on the first side of the
thermistor material, wherein heat is generated on the first side of the thermistor material
between the first and second electrodes, and

~~The print head of claim 4,~~ wherein the plurality of ink channels include one or more channels which dissipate heat at a higher rate than other channels, and the first and second electrodes are located in an arrangement so that the thermistor material generates greater heat in a first area located adjacent the one or more channels than a second area adjacent the other channels.

9. (Previously amended) The print head of claim 8, wherein the plurality of ink channels include outside channels and inside channels, and the first and second electrodes include a first end and a second end and a mid-portion, wherein the first and second ends are wider than the mid-portion, wherein greater heat is generated adjacent the outside channels than adjacent the inside channels.

10. (Previously amended) The print head of claim 8, wherein the plurality of ink channels include outside channels and inside channels, the first and second electrodes include a first end and a second end and a mid-portion, wherein the first and second ends are narrower than the mid-portion, wherein greater heat is generated adjacent the inside channels than adjacent the outside channels.

11. (Currently Amended) An ink jet print head, comprising:
a plurality of ink channels disposed in a common plane, each of said channels
having at least one orifice for projecting ink towards a substrate; and

an ink heater made of a thermistor material having a positive temperature
coefficient, the ink heater having a substantially flat plate configuration with a planar
surface both facing said ink channels and extending in a plane generally parallel to the
common plane of the ink channels, said planar surface being disposed adjacent to the ink
channels;

wherein the thermistor material includes a first side and a second side, and the ink
heater includes a first electrode and a second electrode located on the first side of the
thermistor material, wherein heat is generated on the first side of the thermistor material
between the first and second electrodes, and

~~The print head of claim 4,~~ wherein the ink heater includes:

- a first longitudinal edge,
- a second longitudinal edge,
- a first transverse edge, and

a second transverse edge,

the first longitudinal edge is located opposite from the second longitudinal edge, the first and second longitudinal edges extend in a direction which is substantially perpendicular to the plurality of ink channels,

the first transverse edge is located opposite from the second transverse edge,

the first and second transverse edges extend in a direction which is substantially parallel to the plurality of ink channels,

the second electrode is substantially U-shaped and extends along the first and second longitudinal edges and the first transverse edge, and

the first electrode extends in an area defined by the U-shaped second electrode and in a direction parallel to the first and second longitudinal edges.

12. (Original) The print head of claim 5, further comprising:

a top body portion having a first plurality of ink channel grooves extending in a longitudinal direction;

an intermediate body portion having an upper side and a lower side, a second plurality of ink channel grooves extending in a longitudinal direction along the upper side, the upper side of the intermediate body portion located adjacent the top body portion wherein the first and second plurality of ink channel grooves form the plurality of ink channels;

a main body portion located adjacent the lower side of the intermediate body portion; and

wherein the ink heater is located between the lower side of the intermediate body portion and the main body portion.

13. (Currently Amended) An ink jet print head, comprising:

a plurality of ink channels disposed in a common plane, each of said channels having at least one orifice for projecting ink towards a substrate; and

an ink heater made of a thermistor material, the ink heater having a substantially flat plate configuration with a planar surface both facing said ink channels and extending in a plane generally parallel to the common plane of the ink channels, said planar surface being disposed adjacent to the ink channels;

wherein the ink heater is made of a thermistor material having a positive temperature coefficient,

and wherein the thermistor material includes a first side and a second side, and the ink heater includes a first electrode and a second electrode located on the first side of the thermistor material, wherein heat is generated on the first side of the thermistor material between the first and second electrodes,

a first lead electrically coupled to the first electrode, and a second lead electrically coupled to the second electrode;

a top body portion having a first plurality of ink channel grooves extending in a longitudinal direction;

an intermediate body portion having an upper side and a lower side, a second plurality of ink channel grooves extending in a longitudinal direction along the upper side, the upper side of the intermediate body portion located adjacent the top body

portion wherein the first and second plurality of ink channel grooves form the plurality of ink channels;

a main body portion located adjacent the lower side of the intermediate body portion,

wherein the ink heater is located between the lower side of the intermediate body portion and the main body portion, and

~~The print head of claim 12,~~ wherein the main body portion includes a recess and first and second grooves extending in a longitudinal direction from the recess, wherein the recess receives the thermistor material and the first and second grooves receive the first and second leads, respectively.

14. (Original) The print head of claim 13, wherein the thermistor material is secured to the intermediate body portion with thermally conductive adhesive, and an insulating air gap is formed in the recess between the thermistor material and the main body portion.

15. (Original) The print head of claim 14, further comprising a print head controller electrically coupled to the ink heater, wherein a voltage potential is applied across the first and second leads.

16. (Currently Amended) An ink jet print head comprising:
a top body portion;

an intermediate body portion having an upper side and a lower side, a plurality of ink channels disposed in a common plane along the upper side, each of said channels having at least one orifice for projecting ink towards a substrate, the upper side of the intermediate body portion located adjacent the top body portion;

a main body portion located adjacent the lower side of the intermediate body portion; and

an ink heater made of a thermistor material having a positive temperature coefficient, the ink heater having a substantially planar configuration and is located between the lower side of the intermediate body portion and the main body portion, and extends in a plane generally parallel to the plane of the ink channels and adjacent to the ink channels,

wherein the thermistor material includes a first side and a second side, and the ink heater includes a first electrode and a second electrode located on the first side of the thermistor material, wherein heat is generated on the first side of the thermistor material between the first and second electrodes, and

wherein the plurality of ink channels include one or more channels which dissipate heat at a higher rate than other channels, and the first and second electrodes are located in an arrangement so that the thermistor material generates greater heat in a first area located adjacent the one or more channels than a second area adjacent the other channels.

17. (Currently amended) The print head of claim 2616, wherein the ink heater is made of a thermistor material having a positive temperature coefficient.

18. (Original) The print head of claim 16, wherein the ink heater is made of a ceramic thermistor material.

19. (Currently amended) The print head of claim ~~26~~17, wherein the thermistor material includes a first side and a second side, and the ink heater includes a first electrode and a second electrode located on the first side of the thermistor material, wherein heat is generated on the first side of the thermistor material between the first and second electrodes.

20. (Original) The print head of claim 19, further comprising a first lead electrically coupled to the first electrode, and a second lead electrically coupled to the second electrode.

21. (Original) The print head of claim 19, wherein the plurality of ink channels include one or more channels which dissipate heat at a higher rate than other channels, and the first and second electrodes are located in an arrangement so that the thermistor material generates greater heat in a first area located adjacent the one or more channels than a second area adjacent the other channels.

22. (Currently Amended) An ink jet print head comprising:
a top body portion;

an intermediate body portion having an upper side and a lower side, a plurality of ink channels disposed in a common plane along the upper side, each of said channels having at least one orifice for projecting ink towards a substrate, the upper side of the intermediate body portion located adjacent the top body portion;

a main body portion located adjacent the lower side of the intermediate body portion; and

an ink heater made of a thermistor material having a positive temperature coefficient, the ink heater having a substantially planar configuration and is located between the lower side of the intermediate body portion and the main body portion, and extends in a plane generally parallel to the plane of the ink channels and adjacent to the ink channels,

wherein the thermistor material includes a first side and a second side, and the ink heater includes a first electrode and a second electrode located on the first side of the thermistor material, wherein heat is generated on the first side of the thermistor material between the first and second electrodes, and

~~The print head of claim 19,~~ wherein the ink heater include a first edge and a second edge, the first edge is located opposite from the second edge, the first and second edge extend in a direction which is substantially perpendicular to the plurality of ink channels, the first electrode extends along the first edge and the second electrode extends along the second edge, wherein the first and second electrodes are opposite from one another and substantially parallel.

23. (Currently amended) The print head of claim 1621, wherein the plurality of ink channels include outside channels and inside channels, and the first and second electrodes include a first end and a second end and a mid-portion, wherein the first and second ends are wider than the mid-portion, wherein greater heat is generated adjacent the outside channels than adjacent the inside channels.

24. (Currently amended) The print head of claim 1621, wherein the plurality of ink channels include outside channels and inside channels, the first and second electrodes include a first end and a second end and a mid-portion, wherein the first and second ends are narrower than the mid-portion, wherein greater heat is generated adjacent the inside channels than adjacent the outside channels.

25. (Currently Amended) An ink jet print head comprising:
a top body portion;
an intermediate body portion having an upper side and a lower side, a plurality of ink channels disposed in a common plane along the upper side, each of said channels having at least one orifice for projecting ink towards a substrate, the upper side of the intermediate body portion located adjacent the top body portion;
a main body portion located adjacent the lower side of the intermediate body portion; and
an ink heater made of a thermistor material, the ink heater having a substantially planar configuration and is located between the lower side of the intermediate body

portion and the main body portion, and extends in a plane generally parallel to the plane of the ink channels and adjacent to the ink channels,

wherein the ink heater is made of a thermistor material having a positive temperature coefficient, and

wherein the thermistor material includes a first side and a second side, and the ink heater includes a first electrode and a second electrode located on the first side of the thermistor material, wherein heat is generated on the first side of the thermistor material between the first and second electrodes, and

~~The print head of claim 19,~~ wherein the ink heater includes:

a first longitudinal edge,

a second longitudinal edge,

a first transverse edge and a second transverse edge, the first longitudinal edge is located opposite from the second longitudinal edge,

the first and second longitudinal edges extend in a direction which is substantially perpendicular to the plurality of ink channels, the first transverse edge is located opposite from the second transverse edge,

the first and second transverse edges extend in a direction which is substantially parallel to the plurality of ink channels, and

the first electrode is substantially U-shaped and extends along the first and second longitudinal edges and the first transverse edge, and the second electrode extends in an area defined by the U-shaped first electrode and in a direction parallel to the first and second longitudinal edges.

26. (Currently Amended) An ink jet print head comprising:

a top body portion;

an intermediate body portion having an upper side and a lower side, a plurality of ink channels disposed in a common plane along the upper side, each of said channels having at least one orifice for projecting ink towards a substrate, the upper side of the intermediate body portion located adjacent the top body portion;

a main body portion located adjacent the lower side of the intermediate body portion; and

an ink heater made of a thermistor material, the ink heater having a substantially planar configuration and is located between the lower side of the intermediate body portion and the main body portion, and extends in a plane generally parallel to the plane of the ink channels and adjacent to the ink channels,

~~The print head of claim 16,~~ wherein the main body portion includes a recess and first and second grooves extending in a longitudinal direction from the recess, wherein the recess receives the thermistor material and the first and second grooves receive the first and second leads, respectively.

27. (Original) The print head of claim 26, wherein the thermistor material is secured to the intermediate body portion with thermally conductive adhesive, and an insulating air gap is formed in the recess between the thermistor material and the main body portion.

28. (Original) The print head of claim 27, further comprising a circuit electrically coupled to the ink heater, wherein a voltage potential is applied across the first and second leads.

Claims 29 to 37 (Cancelled).

38. (Previously added) The print head of claim 13, wherein the thermistor material is secured to the intermediate body portion with thermally conductive adhesive.

39. (Previously added) The print head of claim 26, wherein the thermistor material is secured to the intermediate body portion with thermally conductive adhesive.